

Table 1. Study Characteristics and Results of Included Studies (N = 11)

Study	N (OCD/ control)	Age group	Diagnostic and symptom assessments	Comorbidities	Medications	Design	Phases studied	CS	US	Contingency pairing	Physio/ neural marker	Significant results
Nanbu et al, 2010 ¹⁶	60 (39/21)	Adult	<i>DSM-IV</i> criteria by SCID, Y-BOCS	None	SSRI (72%), trazodone (5%), TCA (3%)	Single cue	Acquisition, extinction	CS+: green light	Shock	100%	SCR, EEG	SCR: ACQ: no group differences EXT: OCD: increased SCR (trend) EEG: ACQ: no group differences EXT: OCD: higher S2/S1 ratio than HVs
Milad et al, 2013 ¹⁷	42 (21/21)	Adult	<i>DSM-IV</i> criteria by SCID, Y-BOCS	Dysthymia, PD, SoPh, SpPh, PTSD, GAD	Antidepressant (43%), anticonvulsant (5%), NMDA receptor antagonist (5%)	Differential cue	Acquisition, extinction, retention, renewal	CS: 3 colored lamps (2 separate CS+, 1 extinguished)	Shock	60%	SCR, fMRI	SCR: ACQ: no group differences EXT: no group differences EXT REC: OCD: greater SCR to CS+ fMRI: ACQ: OCD: fail to recruit right caudate, subgenual cortex, and hippocampus EXT: OCD: reduced vmPFC activation EXT REC: OCD: reduced vmPFC, PCC, cerebellum, putamen, hippocampus activation
McLaughlin et al, 2015 ¹⁸	55 (37/18)	Adult	Lifetime (but not necessarily current OCD) by <i>DSM-IV</i> criteria by SCID, Y-BOCS	MDD, BPAD, dysthymia, SUD, PD, SoPh, tics, impulse-control disorder, PTSD, agoraphobia Controls: past MDD and SUD	SSRI (94%), BZD (55%)	Differential cue in context	Acquisition, extinction, retention, renewal	CX: 2 rooms CS: 2 lamp colors	Shock	100%	SCR	ACQ: no group differences EXT: no group differences EXT REC: OCD: impaired recall; first trial had higher SCR to CS+ and CS, only CS+ remained high EXT REN: no group differences
McGuire et al, 2016 ²²	41 (19/22)	Pediatric (7–17 y)	<i>DSM-IV</i> criteria by K-SADS-PL, CY-BOCS, OCI-CV	SpPh, anxiety, ADHD, depressive disorder, tic, disruptive behavior disorder	SSRI (42%) neuroleptic (11%), stimulant (11%), BZD (5%)	Differential cue	Acquisition, extinction	CS: facial expressions	Scream	80%	SCR	ACQ: no group differences EXT: OCD: greater SCR to CS– initially, SCR to CS+ increased over trials
Apergis-Schoute et al, 2017 ²⁵	85 (43/35)	Adult	MINI, Y-BOCS	None	SSRI (42%), TCA (12%), neuroleptic (7%), BZD (2%)	Reversal	Acquisition, reversal	CS: faces	Shock	33%	SCR, fMRI	SCR: ACQ: OCD: stronger differentiation deficit in late acq REV: OCD: impaired differential learning fMRI: ACQ: OCD: increased vmPFC activation to CS+, absent vmPFC CS– activation; increased salience network connectivity to CS+ REV: OCD: increased vmPFC activation to the CS+; absent vmPFC CS– activation
Geller et al, 2017 ^{23,a}	80 (39/41)	Pediatric (7–17 y)	<i>DSM-IV</i> criteria by K-SADS-PL, CY-BOCS	MDD, anxiety, tic	SRI (41%)	Differential cue	Acquisition, extinction	CS: facial expressions	Scream	80%	SCR	ORIENT: OCD: greater response ACQ: OCD: increased to CS+ EXT: OCD: increased to CS+
Geller 2019 ^{24,a}	64 (64/0)	Pediatric (7–17 y)	<i>DSM-IV</i> criteria by K-SADS-PL, CY-BOCS	MDD, anxiety, tic	SSRI (22%), antipsychotic (3%), ADHD/tic (6%)	Differential cue	Acquisition, extinction	CS: facial expressions	Scream	80%	SCR	ACQ: severity and treatment response unrelated EXT: severity unrelated. Treatment responders had improved discrimination
Fyer et al, 2020 ²⁰	166 ^b (41/64)	Adult	<i>DSM-IV</i> criteria by SCID, Y-BOCS	SpPh, tic	None	Differential cue	Acquisition, extinction, retention, renewal	CX: 2 rooms CS: 2 lamp colors	Shock	67%	SCR	ACQ: OCD: stronger response to CS–, but overall no group differences EXT: no group differences EXT REC: OCD: impaired (trend) EXT REN: OCD: increased
Giménez et al, 2020 ¹⁹	30 (17/13)	Adult	<i>DSM-IV</i> criteria by SCID; Y-BOCS	Affective disorder, anxiety disorder	SSRI (82%), SNRI (6%)	Differential cue	Acquisition, extinction, retention	CS: 3 colored lamps (2 separate CS+, 1 extinguished)	Shock	60%	SCR, vmPFC glutamate	SCR ACQ: No group differences EXT: No group differences EXT REC: No group differences vmPFC glutamate levels No group differences EXT REC: OCD: higher levels correlated with decreased EXT REC
Elsner et al, 2021 ²⁶	73 (41/32)	Adult	Y-BOCS, OCI-R	Anxiety, somatoform, MDD	SSRI (29%), <i>Hypericum</i> (2%)	Reversal	Acquisition, reversal	CS: faces	Shock	33%	SCR	ACQ: OCD: impaired differential learning REV: no group differences
Pöhlchen et al, 2021 ²¹	93 (37/53)	Adult	Y-BOCS, OCI-R, MCID	SpPh, phobia, PD, PTSD, MDD, dysthymia, BPAD	SSRI (8%), amphetamine (3%), SSRI + neuroleptic (3%)	Differential cue	Acquisition, extinction, retention	CS: 3 colored shapes (1 CS–, 1 CS+ [shock], 1 CS+ [air puff])	Shock, air puff	75%	FPS, SCR, pupillometry	SCR: ACQ: no group differences EXT: no group differences EXT REC: no group differences FPS: ACQ: no group differences EXT: OCD: increased FPS (trend) EXT REC: no group differences Pupillometry: ACQ: no group differences EXT: no group differences EXT REC: no group differences

^aGeller et al (2017)²³ and Geller et al (2019)²⁴ are from the same sample.
^bStudy included social anxiety disorder and anorexia nervosa as other comparison groups.
Abbreviations: ACQ = acquisition, ADHD = attention-deficit/hyperactivity disorder, BPAD = bipolar affective disorder, BZD = benzodiazepine, CS = conditioned stimulus, CX = context, CY-BOCS = child Yale-Brown Obsessive Compulsive Scale, EEG = electroencephalography, EXT = extinction, EXT REC = extinction recall, EXT REN = extinction renewal, fMRI = functional magnetic resonance imaging, FPS = fear-potentiated startle, GAD = generalized anxiety disorder, HV = healthy volunteer, K-SADS-PL = Kiddie Schedule for Affective Disorders and Schizophrenia-Present and Lifetime, M-CID = Munich-Composite International Diagnostic Interview, MDD = major depressive disorder, MINI = Mini-International Neuropsychiatric Inventory, NMDA = *N*-methyl-*D*-aspartate, OCD = obsessive-compulsive disorder, OCI-CV = Obsessive Compulsive Inventory-Child Version, OCI-R = Obsessive Compulsive Inventory-Revised, PCC = posterior cingulate cortex, PD = panic disorder, PTSD = posttraumatic stress disorder, SCID = Structured Clinical Interview for *DSM-IV* Disorders, SCR = skin conductance response, SoPh = social phobia/social anxiety disorder, SpPh = specific phobia, SRI = serotonin reuptake inhibitor, SSRI = selective serotonin reuptake inhibitor, SUD = substance use disorder, TCA = tricyclic antidepressant, US = unconditioned stimulus, vmPFC = ventromedial prefrontal cortex, Y-BOCS = Yale-Brown Obsessive Compulsive Scale.